DOCUMENT RESUME

ED 120 548 CE 006 942

AUTHOR	Herr, Nicholas K.
TITLE	Decimals and Percents--A Math Practice Booklet.
INSTITUTION	Rutgers, The State Univ., New Brunswick, N.J. Curriculum Lab.
SPONS AGENCY	New Jersey State Dept. of Education, Trenton. Div. of Vocational Education.
REPORT NO	VT-102-621
PUB DATE	Feb 76
NOTE	74p.; For related documents, see CE 006 940-943
AVAILABLE FROM	New Jersey Vocational-Technical Curriculum Laboratory, Rutgers-The State University, Building 4103 Kilmer Campus, New Brunswick, New Jersey 08903 ($1.25)
EDRS PRICE	MF-$0.83 HC-$3.50 Plus Postage
DESCRIPTORS	Arithmetic; Arithmetic Curriculum; *Decimal Fractions; High School Students; Instructional Aids; *Percentage; *Practical Mathematics; Secondary Education; Tests; *Vocational Education; Vocational High Schools; *Workbooks

ABSTRACT

The problems in the workbook are designed to help the vocational high school student understand and become adept at working with decimals and percents. Emphasized are the use of decimals in money and the application of percents to problems in daily living. Topics covered include: addition, subtraction, multiplication and division of decimals; the interrelationship of percents, decimals, and fractions; and the use of percents in interest and discount problems. Exercises with practical applications (called job assignments) constitute the bulk of the text. Quizzes are also included. (RG)

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STATE OF NEW JERSEY
DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL EDUCATION

Decimals and Percents

CE006942

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U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
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State of New Jersey
Department of Education
Division of Vocational Education

DECIMALS AND PERCENTS - A MATH PRACTICE BOOKLET

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February 1976
VT 102 621

NEW JERSEY DEPARTMENT OF EDUCATION – FRED G. BURKE, COMMISSIONER

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CURRICULUM LABORATORY

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BUILDING 4103 – KILMER CAMPUS

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Objectives

Many students have difficulty with decimals and percents. This booklet attempts to make them more understandable, so that problems are solved with some thought, and not merely by rote. In that way it is hoped that there will be some carryover into life situations.

After completing the problems in this booklet, the student should be able to:

1. Understand what a decimal is.
2. Read and write decimal fractions accurately.
3. Add decimals.
4. Subtract decimals.
5. Understand the need for rounding off decimals and know how to do it.
6. Multiply decimals.
7. Divide decimals where there are no remainders.
8. Divide decimals and round-off remainders to specific places.
9. Understand what percents are.
10. Change percents to decimals.
11. Change decimals to percents.
12. Change fractions to decimals.
13. Change decimals and percents to fractions.
14. Solve simple interest and discount problems.
15. Solve other types of problems involving percents.

TO THE STUDENT

Everywhere you look you will find decimals. The odometer in your car measures off miles and tenths of a mile. In machine shop you use a micrometer which measures tenths, hundredths, thousandths, and ten-thousandths of an inch. Batting averages of baseball players are given in decimals. Your body temperature is expressed in whole degrees and tenths of a degree. Measurements in scientific work of all kinds are given in decimals.

But by far the most important use you personally make of decimals is in money. Your paycheck, your grocery bill, your bank account will all include decimals. Therefore our emphasis in this booklet will be on the use of decimals in money.

The booklet will also include work with percents and the application of percent to problems we are likely to come up against in day-to-day living.

Within a few years, as the country gradually converts to the metric system, more and more of our measurements will be made in decimal form, so it is particularly important that you understand the rules for the use of decimals.

I – READING AND WRITING DECIMALS

A decimal is really a short way of writing a *fraction.*

For example, .3 is really the fraction 3/10.
.27 is really the fraction 27/100.
.925 is really the fraction 925/1000

These fractions, you will notice, are all based on the number 10, including 10, 100, 1000, and so on. As a matter of fact, the proper name for a decimal is *decimal fraction,* but we don't usually bother giving it its whole name.

Furthermore, the decimal is a *proper* fraction. No matter how long it is, it is *always less than 1.* For example, the number,

2.76509

stands for a number *larger than 2 but less than 3.* We could add a hundred more digits and we would never get that number up to 3.

Now here's something to think about: *Every number has a decimal point.* If the number doesn't *show* the decimal point, it is understood to be to the right of the number.

The number 25, for example, is really

25.←

or 25 *whole things* – without any fractional parts.

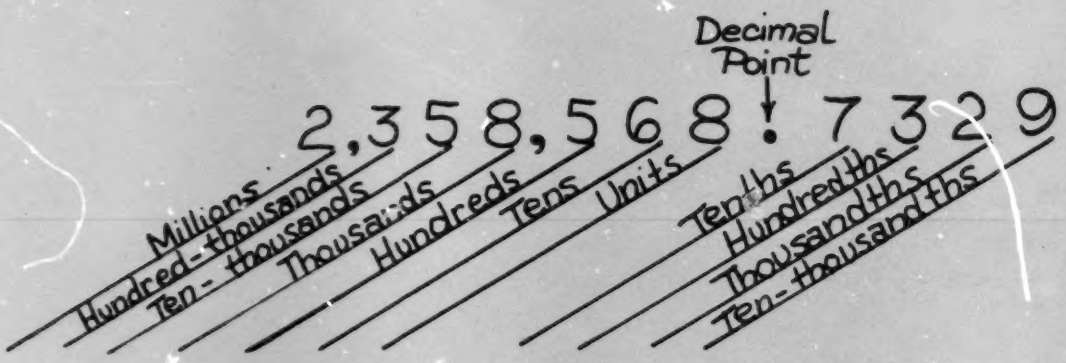
If there were any fractional parts, the number might be

25.2 or 25.4 or 25.35.

So if you don't see a decimal point, you know there really is a decimal point understood at the end of the number.

Whether you will be using decimals in your work or not, you will surely be writing out checks some day, so you must know how to read and write decimals.

Here is a nice big number containing a decimal, with each place given its proper name.



Notice that the numbers found *after* the decimal point are written and pronounced *almost* like the numbers to the left of the decimal point; the only difference is the "th" added to the place-name of the decimals. Here are some examples of how to read decimals:

Example A: Read 79.83

1. First read the number to the left of the decimal point, as usual: "Seventy-nine."
2. Read the decimal point as "and."
3. Read the number to the right of the decimal point as if it were a simple number, and then
4. Add the place-name of the last digit: eighty-three *hundredths.*"

The whole number is therefore read: *"Seventy-nine and eighty-three hundredths."*

Example B: Read 6.735.468.

1. To the left of the decimal point: "Six thousand, seven hundred thirty-five . . ."
2. "and" (for the decimal point) . . . .
3. To the right of the decimal point: "four hundred sixty-eight . . . ."
4. *"thousandths."*

The whole number is read: *"Six thousand, seven hundred thirty-five and four hundred sixty-eight thousandths."*

Example C: Read $12.09. No problem here at all.

1. "Twelve dollars . . . ."
2. "and . . . ."
3. "nine cents."

Job Assignment 1

Read each of the following numbers correctly

(1)	8.3	(11)	4.2	(21)	$115.06
(2)	26.5	(12)	8,563.5	(22)	201.5
(3)	3.836	(13)	80.07	(23)	6.375
(4)	265.55	(14)	1.008	(24)	$4,002.50
(5)	0.25	(15)	96.2	(25)	607.01
(6)	$1.68	(16)	$26.92	(26)	2.999
(7)	62.59	(17)	3.123	(27)	40,000
(8)	7.03	(18)	$1.76	(28)	$20.02
(9)	$45.21	(19)	3.2	(29)	$149.00
(10)	$58.70	(20)	5.61	(30)	$6,507,048.24

II – ADDING DECIMALS

You go shopping in a store and you are ready to check out your items. You have enough money to pay for your groceries but you still must know how much your bill will be. So the cashier punches the prices on a cash register, and when all the groceries have been checked your total appears. What the cash register did was to *add* up all the prices of your groceries and arrive at a total. You could have known this total before you checked out your groceries by adding the prices yourself.

> **Remember:**
> When adding numbers with decimals, always place the decimal points *directly under one another. Do not* line up the numbers = just the decimal points.

Example A: Add 6.3 + 9.2 + 0.3 + 3.0 =

Step I
```
 6.3
 9.2
 0.3
+3.0
```
Write the problem, placing all the decimal points one under the other vertically.

Step II 18.8 (Answer) Simply add the numbers and insert a decimal point in line with all the other decimal points.

Example B: Add 3.6+ .25 + 26.12 + 7.3 + 8.92

Step I
```
  3.6
  .25
 26.12
  7.3
+8.92
```
Write the problem vertically, lining up the decimal points one under the other, as before.

Step II
```
  3.60
  .25
 26.12
  7.30
+8.92
```
Insert zeros to help keep the columns straight when you add. This does not change the value of the numbers.

Step III 46.19 (Answer) Add the numbers and insert a decimal point in line with all the other decimal points.

Job Assignment 2

You are a bookkeeper and must find the total of each day's expense. Find out how much money was spent, each day to pay the office expenses listed here. Also find out how much money was spent on these items for the full week.

Monday

$269.89 – typewriter
3.56 – typewriter ribbons
10.00 – carbon paper

Tuesday

$249.79 – new desk
69.45 – desk chair
29.00 – 10 reams of paper
84.15 – telephone bill

Wednesday

$ 6.00 – coffee for employees
147.00 – electric bill
18.00 – miscellaneous (erasers, pencils)

Thursday

$ 10.00 – 500 time cards
125.63 – shipping cost
25.00 – stamps
43.38 – parcel post

Friday

$1203.49 – payroll
18.00 – check books
18.00 – miscellaneous

Job Assignment 3

You work in a stationery store and your employer asks you to total up his sales for the week. Using the chart below, add up the total sales for each day.

Sales for September 18 – 23, 19___

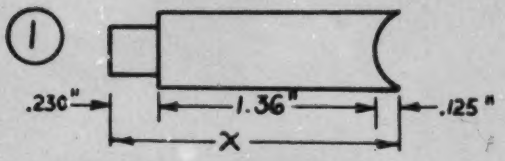
Item	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Paper	$43.13	$40.23	$38.96	$21.52	$34.89	$49.06
Pencils, pens	22.04	5.62	9.21	10.49	30.10	35.75
Note books	59.02	30.00	18.00	19.69	18.63	69.72
Magazines	14.75	13.50	20.50	18.00	31.25	45.55
Other	48.59	37.23	25.49	43.09	41.87	66.49
TOTALS						

Sales for September 25 – 30, 19___

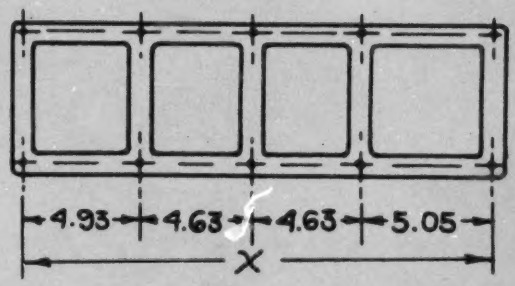
Item	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Paper	$28.00	$23.60	$32.00	$24.69	$45.43	$44.07
Pencils, pens	15.63	9.58	10.50	5.09	16.00	20.96
Note books	45.49	35.18	21.99	48.43	30.89	65.50
Magazines	14.65	12.90	13.40	12.50	31.40	52.35
Other	43.99	37.80	35.00	56.50	54.89	67.06
TOTALS						

Job Assignment 4

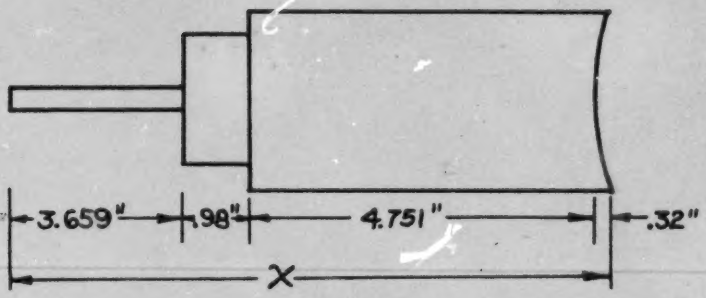
Given the following drawings, find the overall length of each product.

① 

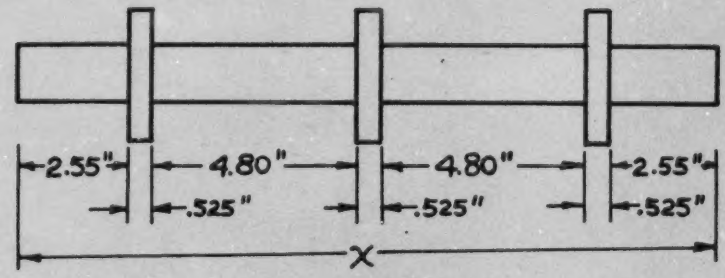
Carbon Brush

② 

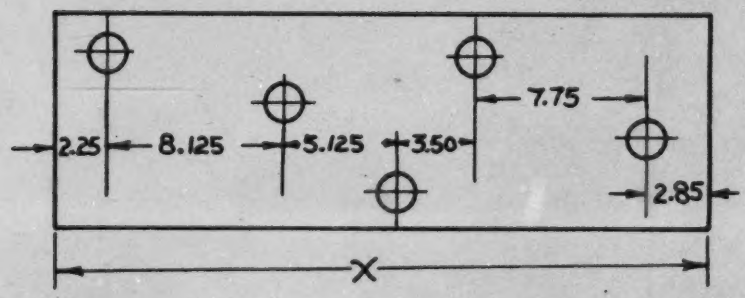
Gasket

③ 

Carbon Alloy Brush

④ 

Roller

⑤ 

Electrical Panel Board

Job Assignment 5

From the pictures at the right, answer the following questions:

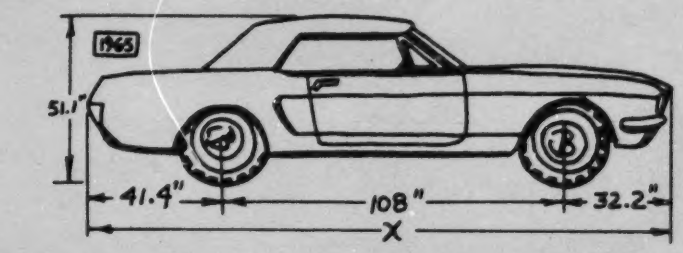
A. How long was the Mustang in 1965?

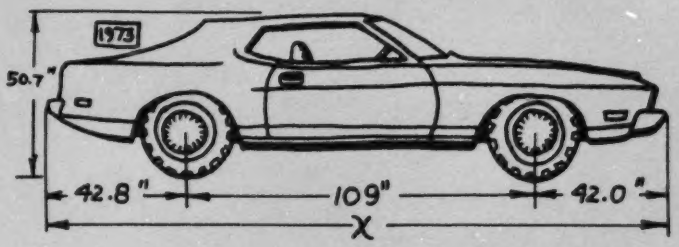
B. How long was the Mustang in 1973?

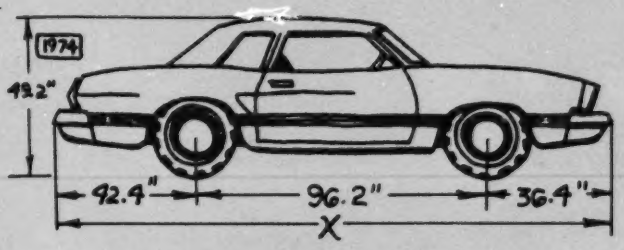
C. How long was the Mustang in 1974?

D. In which year was it the longest?

E. In which year was it the shortest?







Mustang

III – SUBTRACTING DECIMALS

Remember – when subtracting decimals, always line up the decimal point.

Example A: Subtract 8.46 from 9.53.

Step I	9.53 - 8.46	Write the problem, lining up the decimal points. (The word "from" always indicates the upper number.)
Step II	1.07 (Answer)	Subtract the numbers, placing the decimal point in line with the other two decimal points.

Example B: Subtract 2.69 from 3.867

Step I	3.867 - 2.69	Write the problem.
Step II	3.867 - 2.690	If the numbers do not have the same number of decimal places, add a zero or zeros as needed.
Step III	1.177 (Answer)	Subtract, bringing the decimal point straight down.

Example C: Subtract $3.57 from $10.

Step I	$10.00 - 3.57	Write the problem, changing $10 to $10.00 in order to subtract dollars and cents. Subtract. Insert decimal point and dollar sign.
Step II	$ 6.43	

Job Assignment 6

You are a front-end manager in your nearby supermarket. You must compare the sales for two different weeks for each department. If there is an increase the second week, write the amount in the Increase Column; if there is a decrease, write the amount in the Decrease Column.

Total up all columns and check your own figures.

Department	Week 1	Week 2	Increase	Decrease
Grocery	$15,396.48	18,795.31		
Produce	$ 3,506.07	4,136.98		
Meat	$18,107.86	17,746.08		
Dairy	$ 1,962.88	2,355.10		
Delicatessen	$ 738.25	961.23		
Fish	$ 361.49	302.98		
Drugs	$ 572.21	599.83		
Bakery	$ 600.47	492.21		
TOTALS				

Job Assignment 7

Subtract each of the following:

(1) \$58.75 − 24.94	(2) \$164.29 − 23.79	(3) 78.923 − 59.201	(4) 2.387 − 2.196
(5) \$48.36 − 29.19	(6) 2436.796 − 952.879	(7) 24.630 − 19.767	(8) \$76.00 − 29.79
(9) \$189.76 − 187.00	(10) .0008 − .0007	(11) 17.372 − 9.98	(12) 35.3 − 35.309
(13) \$246.73 − 185.09	(14) 25.7395 − 18.62	(15) 79.93 − 48.796	

Job Assignment 8

You are a receptionist for a dentist. Your patients have the following appointment cards showing their total dental bill and the payment per visit. Find each patient's balance after each visit.

GEORGE KANE
APPOINTMENT WITH

Date	Time	Payment	Balance
5/6/__	5:00 p.m.		$155.00
5/13/__	4:30 p.m.	$15.00	
5/20/__	5:00 p.m.	$65.00	
5/27/__	4:00 p.m.	$40.00	

CANDY WILLIAMS
APPOINTMENT WITH

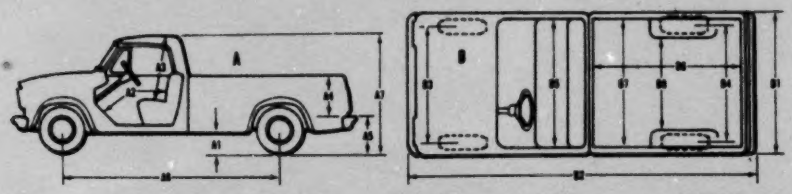
Date	Time	Payment	Balance
4/21/__	2:30 p.m.		$359
4/28/__	3:00 p.m.	$125.00	
5/5/__	3:00 p.m.	$ 50.00	
5/11/__	3:00 p.m.	$ 50.00	
5/28/__	2:30 p.m.	$ 60.00	

GEORGE GRYBICK
APPOINTMENT WITH

Date	Time	Payment	Balance
3/10/	11:30 a.m.		$75.00
3/17/	3:30 p.m.	$10.00	
3/24/	3:30 p.m.	$ 5.00	
3/31/	4:00 p.m.	$15.00	
4/8/	4:00 p.m.	$45.00	

Job Assignment 9

Using the information in the table, answer the following questions:



DIMENSIONS (inches)	CHEVROLET L.U.V.	DATSUN PL 620	FORD Courier	TOYOTA Hi-Lux
A1 Ground clearance	8.1	7.9	8.0	7.5
A2 Front leg room (max.)	42.25	42.5	42.5	41.0
A3 Front head room	37.25	35.5	37.0	36.5
A4 Cargo-box height	15.5	16.5	16.25	16.1
A5 Cargo liftover height	27.9	28.5	29.0	29.7
A6 Wheelbase	102.4	100.0	104.3	99.8
A7 Height	60.8	60.6	61.6	61.8
B1 Width	63.0	62.6	63.0	63.2
B2 Length	173.4	169.0	172.0	165.9
B3 Front track	52.8	51.25	52.6	50.8
B4 Rear track	51.2	52.0	52.6	50.8
B5 Front hip room	48.0	53.0	53.5	54.0
B6 Cargo-box length	72.8	72.5	75.0	72.8
B7 Cargo-box width (max.)	61.0	60.5	62.25	56.3
B8 Cargo-box width (min.)	39.4	38.25	36.625	38.3

A. What is the greatest difference in front leg room between the trucks?

B. Which truck has a wider front track (B3), the Chevrolet L.U.V. or the Datsun? How many inches wider?

C. How much more maximum cargo box width (B7) does the Ford Courier have than the Toyota?

D. What is the difference (in inches) between the longest and the shortest wheelbase (A6)?

E. Which truck has the longest overall length? Compare it to the other three trucks (give the difference in inches).

IV – BASIC TOLERANCE

In the machine shop, where parts are made for all sorts of machines, great accuracy is needed. A part may be, for example, 2.3175" wide. When parts are machined to such exact measurements, a certain *tolerance* is permitted. This is a certain amount that the part is permitted to vary from the perfect measurement.

For example, a hole may be drilled with a diameter of

$$.225 \pm .006"$$

The .006 is called the tolerance. This is a short way of saying that the hole must not vary from the stated size, either larger or smaller, by more than .006". If it does, the piece will be rejected.

Here are three terms you should be familiar with:

Basic size ⇒ actual size specified for the part

Oversize limit ⇒ basic size plus the positive (+) tolerance

Undersize limit ⇒ basic size minus the negative (−) tolerance

Example A: Basic size = 1.365" ± .010"
Oversize limit = 1.365" + .010" = 1.375"
Undersize limit = 1.365" − .010" = 1.355"

This means that the piece of stock or equipment must not be any larger than 1.375" and must not be smaller than 1.355" if it is to be acceptable.

Example B: Basic size = $2.015"\ ^{+\ .002}_{-\ .003}$
Oversize limit = 2.015" + .002" = 2.017"
Undersize limit = 2.015" − .003 = 2.012"

Example C: Basic size = 78 mm ± .4 mm
Oversize limit = 78 mm + .4 mm = 78.4 mm
Undersize limit = 78 mm − .4 mm = 77.6 mm

Job Assignment 10

You are a machinist and have to turn out parts according to the following specifications. For each part, find the oversize limit and undersize limit and write them in the chart.

Part #	Basic Size	Tolerance	Oversize Limit	Undersize Limit
1	1.006"	± .009"		
2	0.075"	± .012"		
3	1.173"	± .010"		
4	0.393"	+ .006 − .003		
5	56 mm	± .2 mm		
6	123 mm	± 1 mm		
7	42.5 mm	+ .05 − .02		
8	1.373"	± .015"		
9	0.925"	± .008"		
10	97 mm	+ .1 − .05		
11	0.870"	± .025"		
12	40.1 mm	± .5 mm		
13	25.75 mm	± .05 mm		
14	0.075"	± .006"		
15	67 mm	± .2 mm		

V – ROUNDING OFF DECIMALS

As we saw on pages 8 and 13, the basic measurements of a car or truck are generally given in inches and tenths of an inch. For example, the wheelbase might be 102.4". On the other hand, the diameter of a piston in the car or truck might be something like 3.127 inches, and the diameter of a bolt might be 0.5625 inches. It would be pretty silly to try to measure a car with the same accuracy as we measure a piston, which has to fit properly into a cylinder.

All of this is by way of saying that *many different degrees of accuracy* are required for different measurements.

At one extreme, we have the kind of accuracy needed for the piston or for parts of machine tools (as in the previous lesson), and at the other extreme we might have, say, the distance from your home to school, or between two cities, or, for that matter, from the earth to the moon!

Suppose you were driving to a friend's house for the first time. Your friend might say, "My house is 2.7 miles beyond the traffic light." Could you find the house? Of course you could. Would it have made any sense for your friend to measure the distance so that he could tell you that the house was 2.7135 miles from the traffic light? Of course not.

Job Assignment 11

In each case in the following list, put a circle around the number that seems more suitable for general use.

1. The distance between the two cities is 35 miles; 34.76 miles.

2. The golfer hit the ball 193.2 yards; 200 yards.

3. The drapes measured 93½ inches; $93\frac{15}{32}$ inches.

4. The population of the United States in 1975 was 221,684, 752; 220,000,000 persons.

6. Candidate A won over Candidate B by 23,167 votes; 23,000 votes.

7. The man earned $11,789.35 last year; $11,800.

8. To lay the walk, the mason will need 2.6322 cubic yards of concrete; 2.6 cubic yards.

9. The area of the lot was 7600 sq. ft.; 7627½ sq. ft.

10. The student was 16 years old; 15 years, 10 months, and 2 days old.

Very often in doing problems we end up with many more figures than we need. They are just excess baggage to carry around. We want to get rid of some of them – depending on the nature of the problem – and give an answer that is practical for our purposes.

Look at the number

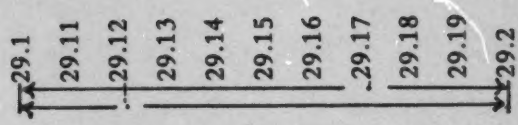
29.17

We will round it off to the *nearest tenth*. (There is a 1 in the tenths place.) What we are asking ourselves is, "Is the number 29.17 closer to 29.1 or to 29.2?" If you think a minute or two, you will see that the number 29.17 is closer to 29.2. Therefore, rounded off to the nearest tenth, 29.17 becomes 29.2.

On the other hand, look at the number

29.12

This number is closer to 29.1 than to 29.2. Therefore, rounded off to the nearest tenth, 29.12 is 29.1.



29.12 is closer to 29.1

29.17 is closer to 29.2

Rounding off is used most often with decimals, although it may be used with whole numbers also, as we saw in job assignment 11. There are several different systems for rounding off numbers. We will use the most common one.

Let us go back to

29.17,

to be rounded off to the nearest tenth.

Look at the *digit to the right of the digit in the tenths' place*(7). If this number is *less than 5*, just drop it. If this number is *5 or more*, increase the number in the tenths' place by 1 and drop the number. Since 7 is greater than 5, we increase the 1 to 2 and drop the 7. Rounded off to the nearest tenth, then, 29.17 becomes

29.2.

Let us state the above rule in a general way, and then make it clearer by giving other examples.

To round off a number to a certain place:

1. Look at the digit to the right of that place.
2. If that digit is less than 5, drop it and any other digits farther to the right. Leave the rest of the number as it is.
3. If that digit is 5 or more, increase the digit in the required place by 1 and drop that digit and any other digits farther to the right.

Example A: Round off \$39.165 to the nearest cent.

Step I	\$39.165 ↑	Write the problem and note which place is to be kept.
Step II	\$39.165	Look at the digit to the right of that place. Underline it if you like. Since it is 5 (or larger),
Step III	\$39.17 (Answer)	Increase the digit in the required place by 1 and drop all the digits to the right of it.

Example B: Round off \$24.463 to the nearest cent.

Step I	\$24.463 ↑	Write the problem and note which place is to be kept.
Step II	\$24.463	Look at the digit to the right of that place. Underline it if you like. Since it is less than 5,
Step III	\$24.46 (Answer)	Leave the digit in the required place as it is and drop the digit to the right.

Example C: Round off 5.2351 to the nearest tenth.

Step I	5.2351 ↑	Write the problem. Note the place to be kept.
Step II	5.2351 ↑	Note the digit to the right. It is less than 5.
Step III	5.2 (Answer)	Drop it and the other digits to the right. Leave the digit in the required place as it is.

Job Assignment 12

A. Round off these numbers to the nearest tenth:

(1)	45.29	(6)	3.502
(2)	45.22	(7)	12.05
(3)	45.2299	(8)	12.0555
(4)	45.2987	(9)	326.18
(5)	3.68	(10)	620.549

B. Round off these numbers to the nearest hundredth:

(1)	34.376	(6)	69.75499
(2)	3.1416	(7)	69.75500
(3)	200.3921	(8)	101.219
(4)	13.493	(9)	28.0607
(5)	55.525	(10)	2615.005

C. Round off these amounts to the nearest cent:

(1)	$15.675	(6)	$4.9609
(2)	$23.028	(7)	$ .365
(3)	$224.993	(8)	$1.9723
(4)	$135.365	(9)	$4215.505
(5)	$2.1372	(10)	$6.3175

Example D: Round off 16.298 to the nearest hundredth.

Step I	16.298 ↑	Write the problem. Note the place to be kept.
Step II	16.29$\underline{8}$	Note the digit to the right. It is more than 5.
Step III	$\overset{1}{16.20}$	In adding 1 to 9, we get 10. We put down the 0 and carry the 1 to the next place.
Step IV	16.30 (Answer)	Add the 1 to the 2.

Note that the number 16.30 is correct to the nearest *hundredth*. The number 16.3 is correct to the nearest *tenths*. In other words, 16.30 stands for a whole collection of numbers between 16.295 and 16.304, while 16.3 stands for a collection of numbers between 16.25 and 16.34.

In filling out your income tax return, you are permitted by the Internal Revenue Service to round off all your figures to the nearest whole dollar.

Example E: Round off \$207.43 to the nearest whole dollar.

Step I	\$207.43 ↑	Write the problem. Note the place to be kept.
Step II	\$207.43	Note the digit to the right. It is less than 5.
Step III	\$207	Leave the digit in the required place as it is and drop the digits to the right.

Example F: Round off \$3199.56 to the nearest whole dollar.

Step I	\$3199.56 ↑	Write the problem. Note the place to be kept.
Step II	\$3199.56	Note the digit to the right. It is 5.
Step III	\$3190 1	In adding 1 to the 9, we get 10. We put down the 0, and carry the 1 to the next place.
Step IV	\$3200 (Answer)	Finish the problem by carrying as many times as necessary.

Job Assignment 13

A. Round off these numbers to the nearest tenth:

(1)	15.732	(6)	62.604
(2)	15.756	(7)	59.01
(3)	21.93	(8)	136.97
(4)	21.95	(9)	90.85
(5)	21.99	(10)	100.05

B. Round off these amounts to the nearest cent:

(1)	$12.245	(6)	$16.6667
(2)	$122.295	(7)	$45.497
(3)	$3.0552	(8)	$34.9929
(4)	$10.1549	(9)	$34.995
(5)	$21.6333	(10)	$27.698

C. Round off these amounts to the nearest whole dollar:

(1)	$20.23	(6)	$21.98
(2)	100.50	(7)	$360.95
(3)	26.72	(8)	$369.95
(4)	$29.72	(9)	$399.95
(5)	$4325.09	(10)	$ .75

VI – MULTIPLYING DECIMALS

The only problem in multiplying decimals – aside from remembering the multiplication table – is putting the decimal point in the right place in the answer.

You cannot say "I got the answer right *except* for the position of the decimal point." If the decimal point is in the wrong place, the answer is *wrong*!

There is a great difference in meaning between, say,

29.86 and 2.986.

The first number is roughly 30, and the second number is roughly 3. If someone paid you $2.986 instead of $29.86, you would certainly know the difference!

That is why you must be very careful to get the decimal point in the right place in the answer.

To multiply decimals:

1. Multiply the numbers as usual.
2. Count the total number of decimal places in the two multipliers.
3. In the answer, start from the right and count off that number of places. Insert the decimal point.

Example A: Multiply 8.5 by 6.

Step I	8.5 X 6		Write the problem vertically.
Step II	8.5 X 6 510		Multiply the numbers.
Step III	8.5 6 51.0	*One decimal place* *No decimal place* *One decimal place*	Count the number of decimal places in each multiplier (1 in this problem). Then count the same number of places in the answer, from right to left.

Example B: Multiply 9.6 by 4.9.

Step I	9.6 X 4.9	Write the problem vertically.
Step II	9.6 4.9 86 4 384 470 4	Multiply.
Step III	9.6 *One decimal place* 4.9 *One decimal place* 86 4 384 47.04 *Two decimal places from right to left.*	Count the number of decimal places in each multiplier (2); then count two places from right to left in the answer.

Multiplying by small decimal numbers is a problem we frequently come across. Sales taxes, business discounts, and interest charges are three examples. In these cases we sometimes find that we do not have enough places in the answer for the decimal point. In such a case, we must *insert enough zeros* to give us the proper place for the decimal point.

Example C: Multiply 1.25 by .05.

Step I	1.25 X .05	Write the problem.
Step II	1.25 .05 6 25	Multiply.
Step III	1 . 2 5 . 0 5 . 0 6 2 5	Count off a total of 4 places. Answer has only 3 places. Therefore insert a zero and put decimal point in front of it to make 4 places.

Job Assignment 14

A. Multiply the following. Round off all answers to two decimal places (hundredths) if they have more places.

1)	5.6 x 3	9)	6.25 x 1.9	17)	13 x 4.65
2)	8.9 x 7	10)	.35 x 2.6	18)	8.4 x .02
3)	13 x 7.4	11)	.07 x .8	19)	2.5 x 2.5
4)	8 x 7.6	12)	12.5 x 3.7	20)	6.5 x 6.5
5)	13.4 x 36	13)	57.6 x 35	21)	1.67 x .04
6)	41.4 x 3	14)	3.2 x 5.63	22)	.35 x .05
7)	6.3 x 1.5	15)	1.12 x 2.36	23)	2.4 x .25
8)	70.4 x 2.5	16)	.75 x .31	24)	.63 x .125
				25)	2.7 x .025

B. Joseph Hoffman is about to buy an air conditioner. The Sea-Breeze brand has an energy efficiency ratio (EER) of 6, and the Kool-It brand has an EER of 9.3. (These figures were obtained by dividing the output – 8000 BTU's in each case – by the number of watts required to operate the air conditioner – 860 watts for the Sea-Breeze brand and 1350 watts for the Kool-It brand.) Mr. Hoffman estimated that he might use the air conditioner an average of 600 hours in a typical summer.

1. At 6 cents per kilowatt-hour, what would be the cost of running each brand for a summer? (1350 watts = 1.35 kilowatts per hour; 860 watts = .86 kilowatts per hour.) What is the difference in the cost?

2. If the Sea-Breeze brand costs $50 more to buy than the Kool-It brand, how many summers would it take for Mr. Hoffman to save the $50 difference in cost?

Job Assignment 15

You are the payroll clerk and have to find each employee's gross pay. Also find the total amount of money that will be paid out in wages.

ROBERTSON HARDWARE COMPANY

Newark, N. J.

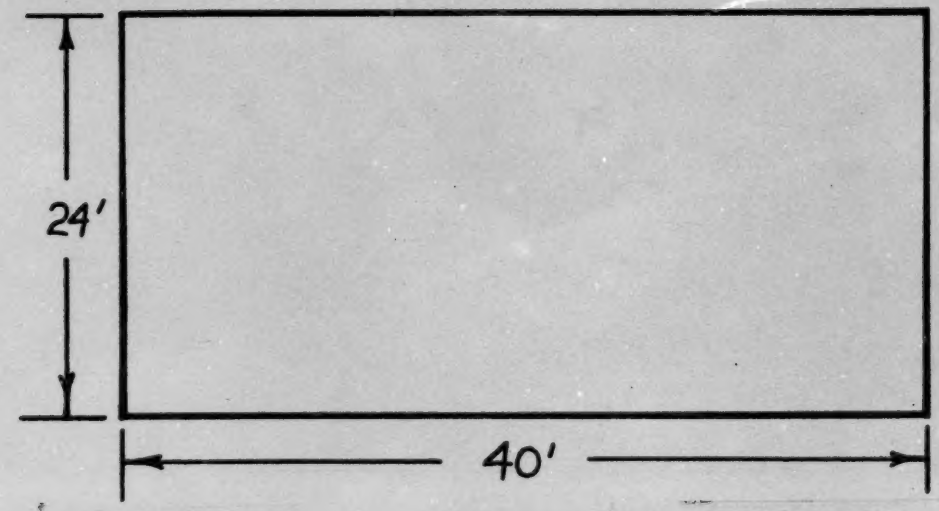
Employee	Hours Worked	Rate of Pay	Gross Pay
Abbate, M.	40	$3.90	
Bolton, J.	35	$4.95	
Carter, R.	40	$3.35	
Dyke, K.	38	$3.50	
Eagens, B.	37	$4.85	
Frisch, M.	23	$4.95	
Gallo, S.	44	$6.40	
Hunt, E.	45	$8.40	
Iario, L.	40	$5.90	
Jackson, R.	38	$4.55	
Lynch, W.	21	$4.85	
		TOTAL	

Job Assignment 16

You are a carpenter and have to finish the basement at the bottom of this page with the items listed below. What will be the cost of each item and the total cost for materials? (When finding the number of each item required, assume that you cannot buy less than a whole item, so increase any fraction to 1.)

Item	Number of boxes	Number in each box	Cost/Item	Cost
Floor Tile 12"x12"		45	$8.55	
Wall Paneling 4'x8'			$10.95	
Ceiling Tile 12"x12"		64	$12.25	
Panel Adhesive	3 Tubes		$ 1.59	
Nails	2		$ .89	
Molding			$ .79 per 4' Sec.	
Studs 2"x4"x8'			$ 1.28	
			TOTAL COST	

Studs are placed 16" on center – Basement height = 8'



Multiplying by Multiples of 10

We often must multiply a number by 10, 100, or 1000. There is an easy way to do this – we simply move the decimal point.

To multiply by 10, move the decimal point 1 place to the right.
To multiply by 100, move the decimal point 2 places to the right.
To multiply by 1000, move the decimal point 3 places to the right.

Every number, you remember, has a decimal point, whether you see it or not. If the decimal point is not shown, then you know it is *to the right* of the number. For example,

28 (no decimal point shown) is actually 28.

Examples:

3.52 x 10 = 3.5.2 = 35.2 (Decimal point moved one place)

3.52 x 100 = 3.52 = 352. (Decimal point moved two places)

3.52 x 1000 = 3.520 = 3520. (A zero was added in order to move the decimal point three places.)

28 x 10 = 28. x 10 = 28.0. = 280. (Decimal point moved one place)

28 x 100 = 28. x 100 = 28.00. = 2800. (Decimal point moved two places)

28 x 1000 = 28. x 1000 = 28.000. = 28000. (Decimal point moved three places)

There is a simple way to remember how many places to move the decimal point. *Move it the same number of places as there are zeros in the multiplier.* For example, there is one zero in 10. So to multiply a number by 10, move its decimal point one place to the right. Move it two places for 100, three places for 1000, etc. To multiply a number by 1,000,000, move the decimal point six places (six zeros in 1 million).

As our country converts to the metric system, it will become more and more important for you to know how to multiply by 10 and the numbers that are multiples of 10 – 100, 1000, etc.

Job Assignment 17

A. Multiply the following by 10:

(1) 3.52	(6) 8.25	(11) .69
(2) 28	(7) 82.5	(12) .04
(3) 16.49	(8) 825	(13) 623
(4) 16.4	(9) .825	(14) 6230
(5) 1.64	(10) 1.06	(15) 100

B. Multiply the following by 100:

(1) 4.15	(6) 1.7729	(11) 606
(2) 415	(7) .003	(12) 2.95
(3) .397	(8) 124	(13) 15.01
(4) 62.59	(9) 12.4	(14) .0003
(5) .0215	(10) 1.24	(15) 100

C. The chart in the newspaper gave a list of figures, and at the top was written "Annual Production (In Thousands)." Write the true meaning of these figures from the newpaper chart:

(1) 516.7	(4) 201.96	(8) 120.
(2) 224.5	(5) 39.88	(9) 297.
(3) 33.9	(6) 4.195	(10) .35
	(7) 16.7	

D. Another chart was called: "Earnings for the Year (In Millions)." What is the true meaning of these figures from the chart?

(1) 62	(3) 570	(5) 6.8
(2) 37	(4) 4.1	

VIII – DIVIDING DECIMALS

Before we actually divide decimals, let us review a couple of facts:

1. Every number has a decimal point, whether we see it or not – as we just recalled (page 28).

2. We can multiply both parts of a division problem by the same number without changing its value. For example,

$$\frac{4}{5} = \frac{4 \times 10}{5 \times 10} = \frac{40}{50}$$

If we divide

$$4 \overline{)64,}$$

we really are dividing

$$4 . \overline{)64.}$$

and we know how to do this. But sometimes we must divide something like this:

$$.4 \overline{)64}$$

In order to get the proper place for the decimal point in the answer, we first must understand that we are really dividing

$$.4 \overline{)64.}$$

Then we must get rid of that pesky decimal point in the divisor (.4). To do this we multiply both the divisor (.4) and the dividend (64.) by the same number – 10.

$$.4 \times 10 = 4.$$

$$64. \times 10 = 640. \text{ (Adding a zero in order to move the decimal point one place)}$$

Our problem is now

$$4. \overline{)640.}$$ and we can go ahead and do it.

Let us summarize what we have done in a general rule, and then we will study a few examples.

1. If there is a decimal point in the divisor (number outside division box), move the decimal point as far to the right as possible.
2. In the dividend (within the box), move the decimal point the *same number of places* to the right. If there are not enough places in the dividend, add zeros.
3. Place the decimal point for the quotient directly above the decimal point in the dividend.
4. Carry out the division.

Example A: Divide 6.3 by 3.

Step I $3\overline{)6.3}$

Write the problem in division form: 3 is the divisor, 6.3 is the dividend, and the answer (quotient) will be written above the box as usual.

Step II $3\overline{)6.3}$ (↑ under the decimal point)

There is no decimal point in the divisor, so no decimal points have to be moved. Place a decimal point in the quotient *right above* the decimal point in the dividend.

Step III

$$\begin{array}{r} 2.1 \\ 3\overline{)6.3} \\ 6 \\ \hline 03 \\ 3 \\ \hline \end{array}$$

2.1 Quotient (Answer)

(No remainder)

Carry out the division problem. Answer is 2.1

Example B: Divide 6.25 by 2.5

Step I $2.5\overline{)6.25}$

Write the problem in division form

Step II $2.5\overline{)6.25}$

Move the decimal point in the divisor all the way to the right (1 place here).
Move the decimal point in the dividend the same number of places to the right (1 place).
Place a decimal point *now* in the quotient, directly over the one in the dividend.

Step III

```
      2.5  Quotient
25. ) 62.5   (Answer)
      50
      ---
      125
      125
      ---
(no remainder)
```

Carry out the division problem Answer is 2.5

Example C: Divide 21 by .75

Step I

```
.75 ) 21
```

Write the problem in division form

Step II

```
.75. ) 21 .00
```

Move the decimal point in the divisor two places.
Move the decimal point in the dividend two places. It is necessary to insert two zeros in order to get the two places.
Place the decimal point in the quotient directly above the point in the dividend.

Step III

```
      28. (Answer)
75. ) 2100.
      150
      ----
       600
       600
      ----
(no remainder)
```

Carry out the division. Answer is 28.

Job Assignment 18

Divide the following:

(1) 16.6 ÷ 2

(2) 35 ÷ .5

(3) 100.8 ÷ .4

(4) 4.93 ÷ 29

(5) 4.522 ÷ 14

(6) 21.00 ÷ 2.8

(7) 718.2 ÷ 114

(8) 1.3725 ÷ 3.05

(9) 102.81 ÷ 6.9

(10) 207 ÷ .23

(11) 23.52 ÷ 5.6

(12) 548.34 ÷ 7.03

(13) 75.85 ÷ 37

(14) 1045 ÷ 9.5

(15) 2.581 ÷ 2.9

No doubt you were happy to see that all the division problems in job assignment 18 came out even. But as you well know, division problems do not always come out even. You have usually expressed the remainder as a fraction, or simply as "Remainder." In actual business or trade use, however, remainders are generally expressed as decimals. That is, the division is carried out as far as necessary, and the answer is then *rounded off* to the number of places required.

Go back now to page 18 and review the rules for rounding off numbers.

Before we study examples of rounding off answers in division problems, let's be sure that we understand this about decimals: We can add as many zeros *after* a decimal point as we like without changing the value of a number. For example, for the purpose of calculating, the number 506 can be written 506.0, or 506.00, or even 506.00000000.

We did this at times to help make adding and subtracting of decimals easier. We will find that we sometimes have to do this to help us in the division of decimals.

Example A: Divide and give your answer correct to the nearest tenth: $7.4\overline{)63.9}$

Step I	$7.4\overline{)63.9}$	Write the problem.
Step II	$7_{\wedge}4\overline{)63_{\wedge}9.}$	Move the decimal point in both the divisor and dividend and place a decimal point in the quotient.
Step III	$74.\overline{)639.00}$	Since the problem is to be rounded off to *tenths* the answer will be carried out to the *hundredths* place. Since there is no digit in the hundredths' place, add 2 zeros in the dividend.
Step IV	$74\overline{)639.00}$ (8.63; 592; 470; 444; 260; 222; 38)	Carry out the division until you are sure what number you will get in the hundredths' place in your quotient. In this case the number is 3. (The remainder of 38 will not make any difference in the answer.)
Step V	8.63 = 8.6 Answer	Since 3 is less than 5, drop it. Your answer, correct to the nearest tenth, is 8.6.

Example B: Divide and give your answer correct to the nearest hundredth. $6.3\overline{).2916}$

Step I	$6.3\overline{).2916}$	Write the problem.

Step II	$6 \times 3. \overline{)\times 2.916}$	Move the decimal points and place a decimal point in the quotient. Since the answer is to be rounded off to hundredths, the answer will be carried out to the thousandths place.
Step III	$\begin{array}{r} .046 \\ 63\overline{)2.916} \\ 00 \\ \hline 291 \\ 252 \\ \hline 396 \\ 378 \\ \hline 18 \end{array}$	Carry out the division until you are sure what number you will get in the thousandths' place in your quotient. In this case the number is 6. (The remainder of 18 will not make any difference in the answer.)
Step IV	.046 = .05 Answer	Since 6 is greater than 5, the number in the hundredths' place (4) is increased by 1 and the 6 is dropped. The answer, .05, is correct to the nearest hundredth.

Job Assignment 19

A. Divide the following. Give your answers correct to the nearest tenth.

(1) 338 ÷ 33

(2) 2.467 ÷ 3.2

(3) 85.3 ÷ .6

(4) .357 ÷ 4.2

(5) 3.52 ÷ 4

(6) .8695 ÷ .12

(7) .0056 ÷ .07

(8) 8.963 ÷ 2.5

(9) 62.5 ÷ .09

(10) 62.5 ÷ 32

B. Divide the following. Give your answers correct to the nearest hundredth or cent.

(1) 48.917 ÷ 1.6

(2) 5963.4 ÷ 2.1

(3) 58.765 ÷ .3

(4) .687 ÷ 42

(5) $87.64 ÷ 15

(6) $6.65 ÷ 63

(7) 14.75 ÷ 2.14

(8) $15.48 ÷ 29

(9) 2.61 ÷ 1.5

(10) $4.87 ÷ 25

Job Assignment 20

You and some friends work in the housekeeping department of Frolic Club Unlimited. You shared the tips listed for each day below. How much money will each of you receive from the tips?

FROLIC CLUB UNLIMITED

Rt. 517

McAfee, N. J.

Bonus Report

For Week Ending Sept. 30, 19___

Day	Date	Receipts	No. of Employees	Share
Monday	Sept. 25	$ 59.50	7	
Tuesday	26	56.25	8	
Wednesday	27	70.00	9	
Thursday	28	78.10	11	
Friday	29	115.35	14	
Saturday	30	238.25	23	

Job Assignment 21

You use your Duster for driving in connection with your work and want to check the number of miles you get per gallon of gasoline. You keep a record of the number of gallons you buy each week and the number of miles you have driven between fill-ups. The figures for each week are given below. Figure out your mileage for each week correct to the nearest tenth of a gallon. Then get the average mileage for the full period.

Dates	Miles Driven	Gallons Purchased	Miles/Gallon
1/7 – 1/11	210.7	11.2	
1/14 – 1/18	242.3	12.6	
1/21 – 1/25	235.9	11.7	
1/28 – 2/1	267.1	13.3	
2/4 – 2/8	310.5	15.7	
		Average	

Job Assignment 22

You change cars with your wife and start driving your Impala on the job. You record your mileage and gallons bought. Work out the same figures for the Impala as you did for the Duster.

Dates	Miles Recorded	Gallons Purchased	Miles/Gallons
3/25 – 3/29	225.3	15.8	
4/1 – 4/5	275.0	18.1	
4/8 – 4/12	176.9	11.2	
4/15 – 4/19	259.2	16.4	
4/22 – 4/26	315.9	21.9	
		Average	

Job Assignment 23

You pay for your gas by credit card, getting itemized bills each month. You are interested to learn just how much per gallon you've paid on the average, so, bills in hand, you set out to find out. Figure out, to the nearest tenth of a cent, what you paid each week, and what the average price was per gallon during this period.

Dates	Gallons Purchased	Cost of Purchase	Cost/Gallon
1/7 – 1/11	11.2	$ 4.75	
1/14 – 1/18	12.6	$ 5.85	
1/21 – 1/25	11.7	$ 5.35	
1/28 – 2/1	13.3	$ 7.05	
2/4 – 2/8	15.7	$ 9.05	
3/25 – 3/29	15.8	$10.00	
4/1 – 4/5	18.1	$12.43	
4/8 – 4/12	11.2	$ 6.50	
4/15 – 4/19	16.4	$10.95	
4/22 – 4/26	21.9	$13.95	

Dividing by Multiples of 10

Back on page 28 we learned how to multiply by 10, 100, 1000, and so on. We merely moved the decimal point to the right the same number of places as there were zeros in the number we were multiplying by.

We divide by 10, 100, 1000, etc. by doing just the opposite. We move the decimal point *to the left.*

35.2 ÷ 10 = 3.5.2 = 3.52 (Decimal point moved one place)

35.2 ÷ 100 = .35.2 = .352 (Decimal point moved two places)

35.2 ÷ 1000 = .035.2 = .0352 (A zero was added in order to move the decimal point three places.)

$9 \div 10 = 9. \div 10 = .9 = .9$ (Decimal point moved one place)

$9 \div 100 = 9. \div 100 = .09 = .09$ (A zero was added in order to move the decimal point two places)

$9 \div 1000 = 9. \div 1000 = .009 = .009$ (Two zeros added)

Remember:

1. *Multiply* by moving the decimal point to the *right*. This will always make your original number *larger* as you would expect when you multiply by whole numbers.

2. *Divide* by moving the decimal point to the *left*. This will always make your original number *smaller*, as you would expect when you divide by whole numbers.

3. The *number of zeros* in the multiplier or divisor tells you *how many places* to move the decimal point for either multiplying or dividing.

Job Assignment 24

A. Divide by 10:

(1)	3.4	(6)	5	(11)	39.37
(2)	62.5	(7)	17.3	(12)	3.1416
(3)	625	(8)	8	(13)	.02
(4)	62500	(9)	80	(14)	112
(5)	2.2	(10)	.8	(15)	100

B. Divide by 100:

(1)	158	(6)	.6	(11)	10,000
(2)	15.8	(7)	2700	(12)	.7
(3)	1.58	(8)	14.92	(13)	7
(4)	.158	(9)	459	(14)	55.9
(5)	6.7	(10)	45.9	(15)	100

C. Complete this table:

		Multiplied by 10	Divided by 10	Multiplied by 100	Divided by 100
(1)	34.9				
(2)	124				
(3)	250				
(4)	.007				
(5)	6.05				

Quiz on Decimals

Add the following:

(1)
$$\begin{array}{r} 592.875 \\ 8.063 \\ .25 \\ \hline \end{array}$$

(2)
$$\begin{array}{r} 184.3 \\ 52.75 \\ 274.125 \\ \hline \end{array}$$

Subtract the following:

(3)
$$\begin{array}{r} 12.953 \\ -\ 8.671 \\ \hline \end{array}$$

(4)
$$\begin{array}{r} 17.375 \\ -\ 8.93 \\ \hline \end{array}$$

(5)
$$\begin{array}{r} 18.92 \\ -\ 11.175 \\ \hline \end{array}$$

Multiply the following:

(6)
$$\begin{array}{r} 12.911 \\ \times\ 67 \\ \hline \end{array}$$

(7)
$$\begin{array}{r} 31.65 \\ \times\ 7.2 \\ \hline \end{array}$$

Divide the following, giving your answer correct to the nearest hundredth.

(8) $.004\overline{)9.24}$

(9) $5.5\overline{)87.4225}$

Complete this chart:

(10)		Multiplied by 100	Divided by 100
	(a) 98.6		
	(b) 2.07		
	(c) 16		
	(d) .05		
	(e) 2000		

VIII – PERCENTS AND WHAT THEY MEAN

You read in the papers or hear on radio or TV:

"The cost of living has gone up 7 percent since . . ."

"Special sale – 40% off!"

"Regular savings account pays 5½% interest on your money!"

Just what does this "percent" really mean?

Actually, it means "for each hundred." In other words, 5% means 5 out of every 100; 40% means 40 out of every 100, and so on.

So if we say, for example, that 75% of the students in this school are expected to graduate, it means that, out of every 100 students who enter, 75 will later graduate. Or if we say "20% off the price," it means that 20 dollars will be taken off every 100 dollars. (Or 20 cents off every 100 cents.) A 10% increase in price means that the price went up $10 for every $100 it cost originally. (Or 10 cents out of every 100 cents.)

Percents give us a way of comparing different numbers. Which of these scores on a test gives a better grade – 8 problems right out of 10, or 21 problems right out of 25? We have no way of telling unless we work out the percent of correct answers in each case. In other words, we must "translate" 8 out of 10 and 21 out of 25 into numbers that can be compared directly. By using percents, we can figure out how many problems *would have been correct at that same rate* if there had been 100 problems. Then we can tell immediately which is a better grade.

In business particularly, percent calculations are very important, although in everyday living we also see and use percents constantly. Percents are used to figure:

1. **Interest** payments when you borrow or lend money, or buy goods "on time."

2. **Discounts** off the price of goods for paying promptly, or for buying sale merchandise, or for buying a large amount, or for being a favored customer.

3. **Commissions** paid to salesmen.

4. **Tips** paid for services.

5. **Taxes** paid the government on income, value of property, etc.

6. Cost of living figures, employment figures, government budget charts, etc., etc.

7. Relating numbers to each other in countless ways in business, industry, sports.

People are often fooled by percents, however. A store might advertise: "50 percent off list price! Hurry! Buy now!" The 50% discount may be an honest figure, but if the *original price* of the article was much higher than it should have been, the 50% *off* that price may be no great bargain.

A car manufacturer may say "This year our car gets 10% better mileage." This may be true, but if last year's mileage was below what it should have been, then the 10% increase will not give the car buyer better mileage than similar cars would give him.

So – a word of warning about percents. They are a good way to make figures understandable. But it is just as important to look at *what you are basing the percent on* as at the percent itself.

IX – PERCENTS TO DECIMALS

Percents are very handy labels, and they are easy to understand. There is only one trouble with them – they cannot be used to work out problems.

To work problems in arithmetic, *percents must be* changed first to *either decimals* or *fractions.*

First we will learn to change percents to decimals.

The fact that a percent means "out of each hundred" gives us our clue to changing a percent to a decimal. We will divide the percent by 100. (We learned a short way of doing this on page 40.)

10% = 10 out of 100 = $\frac{10}{100}$ = .10. = .10

24% = 24 out of 100 = $\frac{24}{100}$ = .24. = .24

3% = 3 out of 100 = $\frac{3}{100}$ = .03. = .03

In each case, you will note, we dropped the percent sign when we divided by 100.

> To change from a percent to a decimal:
> Move the decimal point two places to the left and drop the percent sign.

Example A: Change 60% to a decimal.

Step I	60%	Write the problem.
Step II	60.%	The decimal point, if not shown, is understood to be to the right of the number.
Step III	.60. .60 Answer	Move the decimal point two places to the left and drop the percent sign.

Example B: Change 66.67% to a decimal.

Step I	66.67%	Write the problem.
Step II	.66.67 = .6667	Move the decimal point two places to the left and drop the percent sign.

Job Assignment 25

Below we have listed the increase in profits of various businesses over last year's profit. Change these percents to decimals.

(1)	67%	(6)	12.5%	(11)	63.75%
(2)	8%	(7)	150%	(12)	14.28%
(3)	4.75%	(8)	33%	(13)	1.25%
(4)	2.33%	(9)	- 25%	(14)	- 2.6%
(5)	100%	(10)	- 9%	(15)	14%

Once you change the percent to a decimal, you can work problems. For example, the ad says, "Take 20% off any item marked with a red tag!" If the item is marked $4.95, what will it cost you?

$$20\% = .20. = .20$$

$$\begin{array}{r} \$4.95 \\ \times \quad .20 \\ \hline .9900 \end{array} \qquad \begin{array}{r} \$4.95 \\ - \quad .99 \\ \hline \$3.96 \end{array} \text{ Answer}$$

Job Assignment 26

1. An auto mechanic making $4.50 an hour receives a 10% raise. What will be his new rate of pay?

2. If 78% of the 2,250 employees of a large department store are salespeople, how many salespeople are there?

3. What is the sales tax on a $9.75 item at a 5% rate?

4. The junior class pledged to donate 15% of the amount earned in fund-raising projects to the school band. If the class earned $1,030, how much did it donate to the band?

5. The refuse collectors signed a contract with a city which promised them a pay scale at 83% of policemen's salaries. If the range for policemen was set at $13,000 to $16,500, what was the range for the refuse collectors?

6. Brazing metal consists of 85% copper and 15% zinc. How many pounds of each are there in 36 pounds of brazing metal?

7. Metal for printing type consists of 70% lead, 18% antimony, 10% tin, and 2% copper. Find the amount of each metal in 50 pounds of type metal.

8. A hi-fi outfit that sold for $225 was offered at a *markdown* of 35%. What was the sale price?

9. A merchant bought $378 worth of goods at a *discount* of 2% for prompt payment of the bill. What did the goods cost him?

10. The social security tax deduction in 1975 amounted to 5.85% of earnings. How much was deducted from a gross pay of $160 a week?
    What was the deduction for the full year?

X – DECIMALS TO PERCENTS

In business and industry, percents are used constantly. It often becomes necessary to change from decimals to percents.

For example, a manufacturer needs to know how good his workers and his machines are. Suppose a machinist turns out a total of 2050 parts, but 47 have to be rejected because they are beyond the tolerance limits. The manufacturer needs to know what percent have been rejected. To find the percent, he divides 47 by 2050, and he gets and answer of .023 But what percent is this?

To change a decimal to a percent, we do just the opposite of what we did to change a percent to a decimal. We *multiply* by 100, and add a % sign. As you know, we multiply by 100 by moving the decimal point two places to the right.

.023	=	.02 . 3%	=	2.3%
.15	=	15 . %	=	15%
1.25	=	1 . 25 . %	=	125%

To summarize the above – to change a decimal to a percent:

> Move the decimal point two places to the right and add the percent sign (%).

Example A: Change .725 to a percent.

Step I	.725	Write the problem.
Step II	.72. 5 = 72.5%	Move the decimal point two places to the right and add the percent sign.

Example B: Change 2.2 to a percent.

Step I	2.2	Write the problem.
Step II	2 . 20 . = 220%	Move the decimal point two places to the right and add the percent sign. Insert a zero to get the two places.

You may at times forget which way to move the decimal point. Students often do. The thing to do is to pick out a favorite coin, say a dime. A dime, expressed as a part of a dollar, is $.10.

$.10 (decimal) = 10% of a dollar (percent)

To get from the decimal to the percent, you have to move the decimal point to the *right*.

If ever you get "lost" in the percent "woods," go back to your favorite coin and get on the path again.

Job Assignment 27

1. Change each of the following decimals to percents.

(A)	.61	(D)	.105	(G)	1.75
(B)	.03	(E)	.25	(H)	2.125
(C)	.15	(F)	.50	(I)	.085
				(J)	.0925

2. The following students took a test consisting of 25 problems. Work out the percent of right answers that each student scored.

Joe	20 correct
Sally	18 correct
Bill	21 correct
John	13 correct
Joan	25 correct

3. In a performance test for gas mileage, the Toyota Corolla scored 29 miles per gallon (m.p.g.) at a steady 60 miles per hour (m.p.h.) and 38 m.p.g. at a steady 40 m.p.h. Compare the rate of gas consumption at 60 with the rate at 40 m.p.h. (Use a percent figure.)

4. Constant-Speed Mileage of Four 1975 Model Cars

	Toyota Corolla		Ford Pinto		AMC Gremlin		Pontiac Astro	
40 mph	38	–	28	–	27	–	34	–
50	35		25		24		31	
60	29		23		20		27	

Above is a table comparing the gasoline mileage figures of four different 1975

cars. In the empty spaces, fill in the percent by which the mileage at 50 and at 60 *decreased* from the mileage at 40 m.p.h. (Hint: Subtract each figure from the mileage at 40 before computing the percent.) Then answer the following questions:

(a) Which car's mileage rate held up best at 50 m.p.h.?
(b) Which car's mileage rate held up best at 60 m.p.h?
(c) Which car is actually most economical to run, from the point of view of gasoline cost?
(d) Explain the difference between (b) and (c).

5. The ad said: "One week special on permanent waves."

Balsam Plus	*Regularly* $12.50	*This week only* $10.00
Helene Glamour	*Regularly* $15.00	*This week only* $11.50
Creme de Menage	*Regularly* $25.00	*This week only* $15.00

Which wave had the largest markdown, in terms of percent?
Is that wave necessarily the best buy? Explain.

6. The efficiency of a machine is given by the formula:

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}}$$

Efficiency is generally stated in percent.

The input of an electric motor is 2610 watts, which is equal to 3.5 horsepower. If the motor delivers 3 horsepower to a load, what is the efficiency (in percent) of this motor?

7. Last year the Eatwell Diner made a net profit of $18,000 for its owner. This year its net profit came to $22,500. By what percent did its profit *increase* this year? (Hint: First find the actual increase in profit in dollars and then the percent.)

8. Down the block from the Eatwell Diner, the Colonial Tavern made a net profit this year of $32,000 for its owner, compared to $30,000 last year. What was the percent of increase this year?

9. Would you rather own the Eatwell Diner or the Colonial Tavern? Explain.

10. Three operators turned out the same machined part one week.
    Operator A had 12 rejects out of 60 parts.
    Operator B had 19 rejects out of 550 parts.
    Operator C had 4 rejects out of 325 parts.
    Which operator did the most accurate work?
    Which operator turned out the greatest number of acceptable parts?

XI – FRACTIONS TO DECIMALS

By now you should realize that common fractions, decimal fractions, and percents are all different ways of saying that we are taking a certain portion of a whole thing. In this section we will change common fractions to equivalent (equal) decimal fractions. We can do this easily enough by simply *performing the division* that that fraction indicates.

To change a fraction to a decimal:

1. Divide the denominator into the numerator.

2. Carry out the division as far as necessary to suit the accuracy of your work. For exact measurements in machine shops, decimal parts of an inch are generally given correct to the nearest thousandth – 3 decimal places.

Example A: Change $\frac{2}{5}$ to a decimal.

Step I	$\frac{2}{5}$	Write the problem.
Step II	$5\overline{)2.00}$	Divide the denominator into the numerator. Add a decimal point and as many zeros as you think you will need. Place the decimal point in the quotient.
Step III	$\begin{array}{r} .4 \\ 5\overline{)2.00} \\ \underline{20} \\ 0 \end{array}$	Divide. (The second zero was not needed.)
Step IV	$\frac{2}{5} = .4$ Answer	(Answer may be given as .40 or .400 if needed for computing or for measuring instruments.)

Example B: Write $\frac{1}{3}$ as a decimal.

Step I	$\frac{1}{3}$	Write the problem.
Step II	$3\overline{)1.0000}$	Divide the denominator into the numerator. Add a decimal point and several zeros.
Step III	$\begin{array}{r} .3333 \\ 3\overline{)1.0000} \\ \underline{9} \\ 10 \\ \underline{9} \\ 10 \\ \underline{9} \\ 10 \\ \underline{9} \\ 1 \end{array}$	Carry out the division to 4 decimal places if it does not come out even. (The decimal will then be suitable for measuring by micrometer or other accurate measuring device.)

Step IV $\frac{1}{3}$ = .333 Answer — Round your answer off to the thousandths' place (again, if it is needed for measuring instruments).

NOTE: If you have a mixed number, it is usually easiest to forget about the whole number for the moment and follow the above steps for the fraction. Place the whole number in front of your decimal fraction when you have found it.

For example, $1\frac{1}{3}$ = 1+ .333 = 1.333.

Job Assignment 28

Change the following fractions to decimals. If you happen to know the decimal equivalent, do not bother to divide, but just write the answer.

(1) $\frac{1}{2}$

(2) $\frac{1}{4}$

(3) $\frac{2}{3}$

(4) $\frac{4}{5}$

(5) $\frac{3}{4}$

(6) $\frac{9}{16}$

(7) $\frac{7}{10}$

(8) $\frac{1}{12}$

(9) $\frac{1}{8}$

(10) $\frac{3}{5}$

(11) $2\frac{9}{10}$

(12) $\frac{1}{16}$

(13) $\frac{5}{8}$

(14) $2\frac{2}{5}$

(15) $1\frac{7}{10}$

(16) $3\frac{1}{3}$

(17) $6\frac{3}{4}$

(18) $\frac{3}{8}$

(19) $\frac{5}{12}$

(20) $4\frac{7}{8}$

XII – DECIMALS AND PERCENTS TO FRACTIONS

We know that all decimals are really fractions based on 10 or 100 or 1000, etc. In this lesson we shall learn to change decimal fractions into common fractions.

To change a decimal to a common fraction:

1. Drop the decimal point.
2. Write the decimal as a numerator.
3. For the denominator use 10 if the decimal has 1 place, 100 if it has 2 places, 1000 if it has 3 places, and so on. Note that the number of *zeros* in the denominator is the same as the number of *digits* in the decimal.
4. (If you *read the decimal correctly*, you can write it immediately as a fraction.) Reduce the fraction to lowest terms.

Example A: Change .25 to a fraction.

Step I	.25	Write the problem.
Step II	$\frac{25}{100}$ numerator / denominator	Drop the decimal point. Place 25 as the numerator and 100 as the denominator (since there are 2 digits in the decimal and 2 zeros in 100).
Step III	$\frac{25 \div 25}{100 \div 25} = \frac{1}{4}$ Ans.	Reduce fraction by dividing numerator and denominator evenly by the same number – in this case 25.

Example B: Change .025 to a fraction.

Step I	.025	Write the problem.
Step II	$\frac{25}{1000}$	Drop the decimal point. Write 25 in numerator (the zero is no longer needed because you dropped the decimal point – it served only to keep the point in the right place.) Put 1000 as the denominator, since there were 3 places in the original decimal.
Step III	$\frac{25 \div 25}{1000 \div 25} = \frac{1}{40}$ Ans.	Reduce the fraction to lowest terms.

Job Assignment 28

Change each of the following decimals to a fraction (in lowest terms)

(1)	.5	(11)	.55
(2)	.15	(12)	.8
(3)	.25	(13)	.001
(4)	.40	(14)	.050
(5)	.05	(15)	.523
(6)	.075	(16)	.125
(7)	.6	(17)	.375
(8)	.75	(18)	.004
(9)	.250	(19)	7.500
(10)	.01	(20)	2.25

Percents to Fractions

Most percents are easily changed directly to fractions, although a few are easier to change to decimals first. Remember that "percent" means "out of a hundred."

Example A: Change 25% to a fraction.

Step I	25%	Write the problem.
Step II	$\frac{25}{100}$	25% means 25 out of 100, or $\frac{25}{100}$
Step III	$\frac{25 \div 25}{100 \div 25} = \frac{1}{4}$ Ans.	Reduce to lowest terms as before.

Example B: Change 37½% to a fraction.

Step I	37½%	Write the problem. Because of the fraction ½, it is easier to change 37½% to a decimal first.
Step II	37½% = 37.5%	First change ½ to .5, as in the previous lesson.
Step III	37.5% = .37.5 = .375	Change the percent to a decimal.
Step IV	$\frac{375}{1000}$	Change the decimal to a fraction.
Step V	$\frac{375}{1000} \div \frac{25}{25} = \frac{15}{40} = \frac{3}{8}$ Ans.	Reduce the fraction.

Job Assignment 29

Change the following percents to fractions. Reduce to lowest terms wherever possible.

(1)	10%	(11)	125%
(2)	35%	(12)	80%
(3)	60%	(13)	150%
(4)	4%	(14)	5%
(5)	40%	(15)	62½%
(6)	50%	(16)	16%
(7)	75%	(17)	2%
(8)	87½%	(18)	½%
(9)	39%	(19)	200%
(10)	78%	(20)	¼%

Certain common fractions, decimals, and percents pop up so often whenever we use figures that we can save a great deal of time if we memorize them. Even if we never leave home without a pocket calculator, we still need to be able to convert percents and fractions to decimals, because decimals are the "language" of calculators. And when figuring markups, discounts, and other similar problems, it saves a lot of time if we know the fractional equivalents of these decimals.

Memorize the following chart:

$\frac{1}{2}$ = 50% = .5	$\frac{1}{8}$ = 12½% = .125	$\frac{1}{10}$ = 10% = .1
$\frac{1}{3}$ = $33\frac{1}{3}\%$ = .333	$\frac{1}{4}$ = 25% = .25	$\frac{1}{5}$ = 20% = .2
$\frac{2}{3}$ = $66\frac{2}{3}\%$ = .667	$\frac{3}{8}$ = 37½% = .375	$\frac{3}{10}$ = 30% = .3
	$\frac{5}{8}$ = 62½% = .625	$\frac{2}{5}$ = 40% = .4
	$\frac{3}{4}$ = 75% = .75	$\frac{3}{5}$ = 60% = .6
	$\frac{7}{8}$ = 87½% = .875	$\frac{7}{10}$ = 70% = .7
		$\frac{4}{5}$ = 80% = .8
		$\frac{9}{10}$ = 90% = .9

In some trades it is convenient to know the percent and decimal equivalents of sixths, twelfths, and sixteenths also, but if you are in one of those trades, your shop teacher will tell you to do so.

If you forget an equivalent, all you have to do to convert a fraction to a decimal is to carry out the division. And if you forget *that*, just remember what we said back in Unit IX. Pick your favorite coin, write out its equivalent forms and use them as a model to figure out the problem at hand. For example,

$.25 (decimal) = 25% of a dollar = ¼ (a quarter of a dollar)

(The ¼ can be found by dividing 25 by 100.)

Job Assignment 30

Fill in all the missing spaces in the following chart. Where you have not memorized the equivalent, work it out by the way that you have found easiest.

Complete the following chart:

	Common Fraction	Decimal Equivalent	Percent		Common Fraction	Decimal Equivalent	Percent
(1)	$\frac{1}{4}$	.25	25%	(15)			15%
(2)	$\frac{1}{6}$			(16)		.75	
(3)	$\frac{3}{5}$			(17)	$\frac{2}{3}$		
(4)	$\frac{1}{8}$			(18)		.375	
(5)	$\frac{3}{16}$			(19)			2%
(6)	$\frac{1}{3}$			(20)			9%
(7)		.3		(21)			62½%
(8)		.65		(22)	$\frac{4}{5}$		
(9)		.05		(23)			56%
(10)			50%	(24)		.04	
(11)		.8		(25)			60%
(12)			20%	(26)	$\frac{5}{6}$		
(13)		.125		(27)	$\frac{7}{8}$		
(14)	$\frac{2}{5}$			(28)		.9	

Small Percents

Sometimes people confuse fractional parts *of percents* with fractions. Sometimes they confuse decimal parts *of percents* with decimals. Look at these percents:

$\frac{1}{2}\%$ = $\frac{1}{2}$ of 1% = .5% = .00 5 = .005 (a *very* small amount)

$\frac{1}{2}$ = 50% = .5 (a much larger amount)

.3% = $\frac{3}{10}$ of 1% = .3% = .00 3 = .003 (a very small amount)

$\frac{3}{10}$ = 30% = .3 (a much larger amount)

Though we sometimes see these percents standing alone, more often we are likely to see them combined with whole numbers, and then they are not so easily misunderstood.

For example, if you must pay 5¼% interest on $1200, it is not difficult to figure out your interest payment.

5¼% = 5.25% = .05.25 = .0525

1200 x .0525 = $63 interest

Job Assignment 31

Write the decimal equivalent of:

(1) $\frac{1}{4}\%$

(2) $\frac{3}{4}\%$

(3) .8%

(4) $\frac{1}{3}\%$

(5) $\frac{2}{5}\%$

(6) $5\frac{1}{2}\%$

(7) $4\frac{1}{4}\%$

(8) .6%

(9) $2\frac{1}{2}\%$

(10) $1\frac{1}{8}\%$

XIII – INTEREST AND DISCOUNTS

Interest is money paid for the use of someone else's money.

If you borrow money, you must pay it back with an extra amount (the interest), because you were able to use that money as if it had been yours. You may have bought a car, or paid a doctor's bill or repaired your house plumbing, or whatever.

When you put money into a savings account, the bank makes use of *your* money and pays *you* interest.

Some terms related to interest:

Principle (P) – the amount of money that is borrowed
Rate (R) – the percent to be paid for the loan
Time (T) – the amount of time that you have to pay back the loan.

To find simple interest:

Multiply the principle by the rate (as a decimal) by the time (in years if the rate is stated in years, or in months if the rate is stated in months).
Or, I = P X R X T (This is called a formula.)

Example A: How much interest must be paid on a $2000 loan for 3 years at a rate of 8% a year? How much must be paid back in all?

Step I	I = P x R x T	Write the formula.
Step II	I = $2000 x .08 x 3	Substitute the right numbers for the letters in the formula.
Step III	I = $480	Work out the multiplication.
Step IV	Total Amount = $2000 + $480 = $2480	Add the principle and interest.

Example B: The mortgage (loan) on a home is $25,000 and the mortgage rate (interest) is 7½% per year. This is an old-style mortgage, which must be paid back in a lump sum, with interest, in 25 years. How much interest will be paid on the loan, and what will be the total amount paid back?

Step I	I = P x R x T	Write the formula.

Step II	I = $25,000 x .075 x 25 yrs.	Substitute the proper numbers for the letters of the formula.
Step III	I = $46,875	Work out the multiplication.
Step IV	Total Amount = $25,000 + $46,875 = $71,875	Add the principal and interest.

Example C: Find the interest and the monthly payment on a charge-account balance of $48 at 1½% a month.

Step I	I = P x R x T	Write the formula. Note that the interest rate is given per month and the payment is for 1 month.
Step II	I = $48 x .015 x 1	Substitute the proper numbers.
Step III	I = $.72	Work out the arithmetic.
Step IV	Total Amount = $48.72	Add principal and interest.

The interest we have discussed above is *simple* interest. Although loans and mortgages and charge accounts are generally paid with simple interest, there are many other ways of figuring interest. Savings accounts pay *compound interest*, which is interest paid on the interest as well as on the principal. Finance companies often charge a certain rate which works out to a larger rate on an annual (yearly) basis. This is because the borrower keeps paying some money back and therefore does not have the use of the whole amount of money for the whole time. We will not go into these more complicated ways of figuring interest.

Job Assignment 32

Find the simple interest and total amount to be paid back on the following loans.

	Principle	Rate	Time
1)	$ 500	12%/yr.	1 yr.
2)	$ 1,000	9%/yr.	2 yrs.
3)	$ 6,000	13%/yr.	5 yrs.
4)	$ 250	8½%/yr.	1 yr.
5)	$ 162	1½%/mo.	1 mo.
6)	$ 300	2½%/mo.	4 mos.
7)	$ 575	1%/mo.	3 mos.
8)	$18,000	7¼%/yr.	30 yrs.
9)	$ 2,400	7½%/yr.	3 yrs.
10)	$ 1.350	9½%/yr.	5 yrs.

Discounts

Discounts are percents allowed against the full price of an article.

For example, articles "on sale" in a store are offered with a certain percent taken off the regular price. Many businesses offer a small discount to customers who pay within a certain number of days, to encourage them to pay promptly. Supply houses from which tradesmen buy usually allow a discount to people in the trade, while the general public pays the full price.

The procedure in any discount problem is the same.

Example: Find the selling price (net price) of an article marked

$410, with a 22% discount.

Step I	D = $410 x .22	Write the problem, expressing the percent as a decimal.
Step II	D = $90.20	Do the multiplication.
Step III	A = $410 - $90.20 = $319.80 Answer	Subtract the discount from the original price.

Job Assignment 33

Compute the following discounts and give the net price in each case.

1) 38% of 25.00

2) 2% of $15.50

3) 75% of $76.00

4) 8% of $28.63

5) 11% of $86.00

6) 20% of $33.00

7) 15% of $95.00

8) 37½ % of $48.00

9) 12½ % of $40.00

10) 33 1/3% of $960

ADDITIONAL PERCENT PROBLEMS

In the following problems, use the method that is easiest for you. Remember, however, that a percent itself can never be used in computation – it must always be changed into either fraction or decimal form.

1. A family that earns $1160 a month spends about $325 a month for food. What percent of the family income goes for food?

2. At a social security rate of 5.85%, what is the monthly deduction for social security for the family in problem 1?

3. In New Jersey, the individual worker pays part of the unemployment insurance. At ½%, how much does the same family pay for unemployment insurance each month?

4. To convert cabbage to sauerkraut, add salt in the amount of 2.5% of the weight of the cabbage. How much salt would you add to 24 pounds of cabbage?

5. Out of 48,150 accidents, 230 were fatal (resulting in one of more deaths). What percent were fatal?

6. A piston pin is to be machined to .650" ± .001". What is the total allowable percent of tolerance? (Plus and minus together)

7. In one month the cost of round roast of beef went from $1.49 a pound to $1.69. What was the percent of increase?

8. A plumber estimated 120 ft. of cast iron pipe for a job. He then allowed 5% for waste due to cutting. How many feet did he allow for waste?

9. As a safety measure, a 200 r.p.m. motor has a centrifugal-speed switch set to open at 110% speed. At what number of r.p.m's will the switch open?

10. The input to an electric motor is 96 h.p., and its output at full load is 87 h.p. What is the efficiency of the motor, expressed as a percent?

11. Of 3500 pins produced by an automatic screw machine, 175 were rejected by the inspectors. What percent was rejected?

12. Find the weight of tin and lead in a 2½ lb. bar of solder composed of 40% tin and 60% lead.

13. A certain grade of lumber is supposed to be 75% "clear" or free from knots or other defects. How much clear lumber should a carpenter find in a load of 2500 board feet?

14. A bank charges ½ of 1% for collecting a promissory note of $560. What is the collection charge?

15. A family dining out has a bill of $19.45. They wish to tip the waitress 15%. How much of a tip would they leave? (Use approximate numbers to do the figuring.)

16. A mechanic is allowed a special discount of 20% on anything he buys at a certain supply house. What would he pay for $165 worth of supplies?

17. A salesman is paid 8% commission. What will be his commission on a sale of $242.50?

18. Out of a baseball club of 42 children, 14 were girls. What percent were girls? What percent were boys?

19. If radial tires that are supposed to be inflated to 26 pounds of pressure are run at a pressure of 23 pounds, gasoline mileage for the car will be decreased by 1%.
On a car that gets an overall mileage of 26.5 miles per gallon, how many miles per gallon would be lost?

20. Bias or bias-belted tires under the same conditions as in problem 19 will cause the car's mileage to decrease by 2.5%. On the same car, how much mileage would be lost by driving with these tires at 23 pounds?

QUIZ

Find the *discount* allowed on each of the following:

1) 15 % of $25

2) 33 1/3 % of $67.17

3) 25% of $369.79

4) 50% of $1780

5) 2% of $563

Find the *interest* to be paid on each of the following:

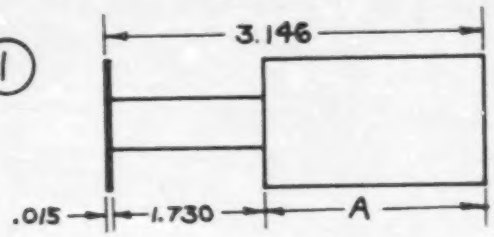
	Principle	Rate	Time
6)	$1,000	12.5 %/yr.	3 yrs.
7)	$2,500	1½ %/mo.	2 mos.
8)	$1,500	9¾ %	2 yrs.
9)	$56.20	2%/mo.	4 mos.
10)	$1,750	7½%	10 yrs.

Complete the Table Below

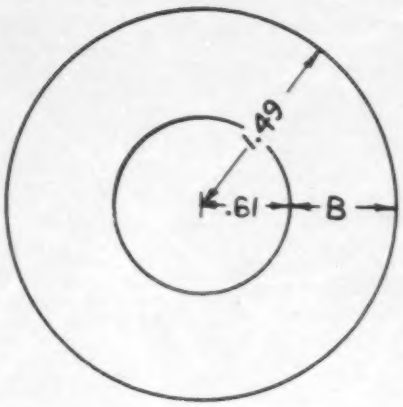
	Common Fraction Equivalent	Decimal Equivalent	Percent Equivalent
11)			25%
12)		.01	
13)			87½%
14)	1/20		
15)		.125	

Review Exercise

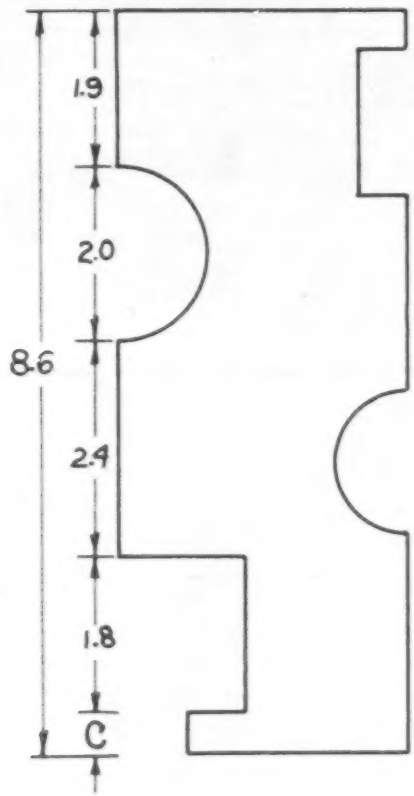
Find the missing dimension in each of the following:

① 

Find A.

② 

Find B.

③ 

Find C.

④

Fraction	Decimal
2/5	
9/10	
3/8	
3/4	
2/3	
1/20	
1/8	
1/3	
5/8	
1/40	

Complete the above chart.